

## WHAT IS CLAIMED IS:

1. An electron gun comprising:
  - a cathode portion which emits electrons;
  - an anode portion which accelerates the emission
  - 5 electrons;
  - a bias portion which is arranged between said cathode portion and anode portion and controls trajectories of the emission electrons;
  - a shielding portion which is arranged below said
  - 10 anode portion and shields some of the emission electrons; and
  - a cooling portion which cools said shielding portion.
2. The gun according to claim 1, wherein a top
- 15 surface of said cathode portion is formed of a hemisphere or a hemispherical member.
3. The gun according to claim 1, wherein said shielding portion includes an incident portion on which the emission electrons become incident, and a tilt
- 20 portion tilting with respect to an incident direction of the incident emission electrons, and said incident portion has a member that confines the emission electrons irradiating said tilt portion.
4. The gun according to claim 1, wherein said
- 25 shielding portion and cooling portion are separable, said shielding portion is made of a high-melting material, and a low-melting material is interposed

between said shielding portion and cooling portion.

5. The gun according to claim 1, wherein said cooling portion includes an insulator, and a cooling medium having a predetermined resistance is passed  
5 through said cooling portion.

6. The gun according to claim 5, further comprising a detecting portion which detects the electrons becoming incident on said shielding portion, and a control portion which controls an application voltage  
10 on the basis of a detection result of said detecting portion.

7. The gun according to claim 1, wherein an electrode is provided between said anode portion and shielding portion, and a voltage is applied to said  
15 electrode.

8. The gun according to claim 1, wherein the electron gun comprises a plurality of electron guns arrayed in a chamber of one atmosphere.

9. The gun according to claim 8, wherein said  
20 plurality of arrayed electron guns respectively include detecting portions each of which detects the electrons becoming incident on said shielding portion, and control portions each of which controls an application voltage on the basis of a detection result of said  
25 detecting portion, said control portions being controlled independently of each other.

10. An exposure apparatus which comprises an electron

gun according to claim 1, and exposes a substrate with an electron beam emitted from said electron gun.

11. An electron beam exposure apparatus comprising:

an electron gun including a cathode portion which  
5 emits electrons, an anode portion which accelerates the  
emission electrons, a bias portion which is arranged  
between said cathode portion and anode portion and  
controls trajectories of the emission electrons, a  
shielding portion which is arranged below said anode  
10 portion and shields some of the emission electrons, and  
a cooling portion which cools said shielding portion;  
and

a stage which moves in holding a substrate to be  
exposed by using the emission electrons.

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12. A device manufacturing method comprising the  
steps of:

exposing a substrate using an electron beam  
exposure apparatus according to claim 11, and

20 developing the exposed substrate.